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EXAMINER

SONG, MATTHEW J

| ART UNIT | PAPER NUMBER |
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1765

DATE MAILED: 03/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/083,613

Applicant(s)

BLISS ET AL.

Examiner

Matthew J Song

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 15-19 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9/29/2003 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

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3. Claims 1-8 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Hirota et al (EP 1 065 299 A2).

Vaudo et al teaches a method of forming a (gallium, aluminum, indium) nitride base layer on a substrate by halide vapor phase epitaxy (HVPE), note entire reference. Vaudo et al also teaches in the HVPE process, HCl is passed over a source of high purity gallium to form GaCl, which is transported to a deposition zone where it reacts with ammonia to form GaN (col 10, ln 15-67). Vaudo et al also teaches subatmospheric pressure conditions, 50 Torr, employed during growth and further reductions in growth pressure are expected to improve uniformity across the wafer and across multiple wafers within one growth run (col 12, ln 25-40). Vaudo et al also teaches a vessel 64 of molten indium, a vessel 69 of molten gallium and a vessel 67 of molten aluminum (col 11, ln 1-40). Vaudo et al also teaches HCl is flowed in contact with indium to form indium chloride which then is transported to the deposition zone where it reacts with ammonia introduced in feed port 74 to form InN on a substrate. Vaudo et al also teaches flowing HCl into contact with gallium and aluminum to form gallium chloride and aluminum chloride, which are transported to a deposition zone where it reacts with ammonia to form GaN and AlN (col 11, ln 15-40).

Vaudo et al does not teach contacting a heated metal with flowing iodine vapor.

In a method of growing III-V nitride semiconductors, note entire reference, Hirota et al teaches a forming GaN by reacting HCl with Ga in a container to form GaCl and reacting the GaCl with nitrogen plasma to form a GaN layer 20 ([0055]). Hirota et al also teaches iodine (I₂) may be introduced as a halogen molecule instead of HCl ([0058]). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Vaudo et al flowing

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HCl with Hirota et al's iodine vapor instead of HCl because substitution of known equivalents for the same purpose is held to be obvious. (MPEP 2144.06).

Referring to claim 2-4, the combination of Vaudo et al and Hirota et al teaches subatmospheric pressures. Vaudo et al does not teach the claimed range of pressure. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 5, the combination of Vaudo et al and Hirota et al teaches Ga, Al and In.

Referring to claim 6, the combination of Vaudo et al and Hirota et al teaches (Ga, Al, In)N.

Referring to claim 7, the combination of Vaudo et al and Hirota et al teach the MI is formed in one locale and then is flowed to another locale to react with ammonia to form MN ('581 Fig 2).

Referring to claim 8, the combination of Vaudo et al and Hirota et al teach deposition on a substrate 56.

Referring to claims 13-14, the combination of Vaudo et al and Hirota et al teach the same reactants and products as applicant, therefore the reaction chemistry is inherently the same as claimed.

4. Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Vaudo et al (US 6,156,581) in view of Hirota et al (EP 1 065 299 A2) as applied to claims 1-8 and 13-14 above, and further in view of Jain (US 4,910,163).

The combination of Vaudo et al and Hirota et al teach all of the limitations of claim 9, as discussed previously, except iodine is placed in a first boat upstream in an elongated first container below an inlet for H₂.

Jain teaches a chemical vapor deposition apparatus, where a continuous tubular reactor is divided into three zones. Jain also teaches in the first zone an iodine boat contains iodine crystals and a resistance heater to elevate the temperature so that iodine is vaporized and admixes with a carrier gas of hydrogen, in the center of the reactor is packed with silicon and in the last zone contains a substrate (col 2, ln 20 to col 3, ln 67). Jain also teaches the iodine and carrier gas passes through the silicon and the iodine reacts with silicon to produce silicon diiodide, which then exits as a part of the gas stream and the silicon diiodide is disproportionated and silicon is deposited on a substrate (col 1, ln 50-67). Jain also teaches the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing (col 1, ln 1-45 and col 4, ln 1-25). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Vaudo et al and Hirota et al with Jain's apparatus with iodine in first boat upstream because the apparatus permits removal and insertion of reactants and removal of product as the process continuous for continuous processing, thereby increasing productivity.

Double Patenting

5. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686

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F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

6. Claims 1-14 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-11 of U.S. Patent No. 6,676,752 in view of Vaudo et al (US 6,156,581).

US 6,676,752 claims a method of forming metal nitrides comprising contacting heated metal with iodine vapor or hydrogen iodine vapor to form metal iodide (MI) and contacting said MI with ammonia gas to form a metal nitride. The limitations of instant claim 5 are taught in claim 2 of US 6,676,752, the limitations of instant claim 6 are taught in claim 3 of US 6,676,752, the limitations of instant claims 7-8 are taught in claims 4-5 of US 6,676,752, the limitations of instant claims 9-10 are taught in claims 6-7 of US 6,676,752, the limitations of instant claim 12 are taught in claim 8 of US 6,676,752 and the limitations of instant claims 13-14 are taught in claims 10-11 of US 6,676,752.

US 6,676,752 does not claim the pressure is subatmospheric.

Vaudo et al teaches a method of forming a (gallium, aluminum, indium) nitride base layer on a substrate by halide vapor phase epitaxy (HVPE), note entire reference. Vaudo et al also teaches in the HVPE process, HCl is passed over a source of high purity gallium to form GaCl, which is transported to a deposition zone where it reacts with ammonia to form GaN (col 10, ln

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15-67). Vaudo et al also teaches subatmospheric pressure conditions, 50 Torr, employed during growth and further reductions in growth pressure are expected to improve uniformity across the wafer and across multiple wafers within one growth run (col 12, ln 25-40).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify US 6,676,752 with Vaudo et al's pressure during growth to improve uniformity across the wafer.

Response to Arguments

7. Applicant's arguments with respect to claims 1-14 have been considered but are moot in view of the new ground(s) of rejection.

8. Applicant's arguments filed 9/29/2003 have been fully considered but they are not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicants allege that Vaudo et al does not teach flowing iodine vapor. The Examiner admitted in the rejection that Vaudo et al does not teach using iodine vapor. However, Vaudo et al is relied upon as a teaching of flowing HCl into contact with a metal to form a metal chloride, which is then reacted with ammonia to form a metal nitride on a substrate (col 11, ln 1-40). Hirota et al teaches using flowing HCl into contact with Ga to form gallium chloride and Iodine vapor can be used instead of HCl (col 14, ln

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20-50 and col 13, ln 45-57). Therefore, the combination of Vaudo et al and Hirota et al teach all the limitations of claim 1.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a flow-through system (pg 5)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicants' argument that Hirota et al does not teach flowing iodine vapor is noted but is not found persuasive. Applicants allege Hirota et al teaches a closed system and not a flow through system, therefore does not teach flowing iodine vapor. However, a flow through system is not required and a closed system is still capable of flowing iodine vapor. Furthermore, Hirota et al specifically teaches flowing vapor. Hirota et al teaches HCl having **flowed** to the bottom part of the reaction tube under the influence of partial pressure reacts with Ga in column 13, line 46-49 and iodine or the like may be introduced into the reaction tube as a halogen molecule instead of hydrogen chloride in column 14, lines 44-46. Therefore, Hirota et al does teach flowing iodine vapor.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the

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applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicants allege that Jain does not teach a two-step process. Jain is provided solely a teaching of providing iodine vapor by using a boat and H₂. A second boat containing a metal is taught by the combination of Vaudo et al and Hirota et al ('581 col 11, ln 25-40). Therefore, the combination of Vaudo et al, Hirota et al and Jain teach all of the limitations of claims 9-12.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Shimoyama et al (US 5,868,834) teaches a vapor phase epitaxy process, where there is no particular restriction on the halide gas or halogen gas, for example, HI or I₂ can be used (col 2, ln 1-67).

Shimoyama et al (US 5,827,365) teaches HI and I₂ are equivalents for manufacturing III-V semiconductors (col 2, ln 30-40 and col 3, ln 1-20).

Steele (US 4,279,670) teaches a container 110 for producing iodide vapor and the iodide vapor is passed through zinc arsenide to form a reactive substance, which deposits on a gallium arsenide substrate (col 4, ln 40-60 and col 7, ln 1-67).

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Moon et al (US 3,856,585) teaches a hydrogen halide is used as a transporting gas and is passed over a III-V source material and deposition takes place on a substrate (abstract).

Vaudo et al (US 2002/0166502) teaches a (Ga,Al,In)N deposition using HVPE involving the reaction of HCl and ammonia at pressure of from about 10-800 Torr ([0048]-[0053]).

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1765

MJS

NADINE G. NORTON
PRIMARY EXAMINER

